



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
08/930,449	10/07/1997	HIROYUKI ABE	JAO-39514	3024

25944 7590 03/11/2002

OLIFF & BERRIDGE, PLC
P.O. BOX 19928
ALEXANDRIA, VA 22320

EXAMINER

RAO, SHRINIVAS H

ART UNIT PAPER NUMBER

2814

DATE MAILED: 03/11/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

08/930,449

Applicant(s)

ABE ET AL.

Examiner

Steven H. Rao

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 November 2001.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2 and 4-63 is/are pending in the application.
- 4a) Of the above claim(s) 19,24,29,34,39,44,45 and 50-55 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-18,20-23,25-28,30-33,35-38,40-43 and 63 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1,2 4-63 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

Response to Amendment

Applicants' amendment filed November 16, 2001 (including the three month extension) has been entered on November 26, 2001.

Therefore claims 20, 25 and 46 as amended by the amendment and claims 1,2, 4-18, 21-23, 26-28, 30-33, 35-38,40-43, and 63 as previously recited are currently pending in the application.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

A. Claims 1-2,4-18,21-23,25-28,30-33, 35-38, are rejected under 35 U.S.C. 103(a) as being unpatentable over Cathey et al. (U.S. Patent No. 5,329,207 herein after Cathey) and Nakamura (U.S. Patent No. 5,200,630 herein after Nakamura) both previously applied for reasons stated in the previous office action and those stated below.

With respect to claims 1,12, 30-35 and 40 in addition to the teachings previously stated, the Applicants' allege the following differences between the applied references and claim 1.

a) Cathey's invention relates to substrates that, "are relatively thick (i.e. greater than 300 microns)" whereas the claimed method utilizes thin films. Cathey does

not teach or suggest any method directed to thin films." (Applicants' response page 4 first 2 paragraphs) .

It is noted that Applicants' claims do not specify the thickness of their substrate layers, but rather recite "thin layers ". The claims also use the open ended language "comprising " therefore without further defining (reciting) any thickness that is recited the claims must be given their broadest interpretation and therefore do not exclude films of different thickness.

Further, it is well settled law that, the limitation on which the applicant relies namely " thin layers " to be less than 300 microns are not stated in the claims. It is the claims that define the invention and it is claims, not specification that are anticipated or unpatentable. ***Constant V Advanced Micro- Devices Inc. 7 USPQ 1064.*** See also *In re Sprock*, 55 CCPA 743, 386 F.2d 924, 155 USPQ 687 (1968) and *In re Lundberg*, 113 USPQ 530 (CCPA 1957).

Even assuming, Applicants' recite the thickness in the claims , Cathey in col. 1 lines 50-52 describes comparatively thin large grain substrates of less than 1 micron thick, thus including all layers less than 1 micron as conventional in the art and goes on to describe the improvements based on this thin film as disclosed by Cathey.

Therefore, contrary to Applicants' allegations Cathey teaches and describes improvements over conventional thin films of less than 1 micron thick.

b) Cathey does not teach or suggest using any particular atmosphere during laser irradiation.

It is noted that Cathey in col. 5 lines 50-53 states," as shown in fig. 3 B. In such a case, the grain boundaries¹ can be hydrogenated to improve mobility of the electrons within the substrate.

Further in col. 6 lines 56-58 describing other embodiments, " In such cases, the grain boundaries can be hydrogenated to improve the mobility of the electrons within the substrate."

Therefore Cathey clearly describes in several of its embodiments describes hydrogenation by any method including using H- containing atmosphere .

c) Applicants' arguments regarding Cathey col. 6 lines 49-58 wherein it is alleged that Cathey describes using the substrate "as it is" and the substrate is not recrystallized is not persuasive because applicants' are referring to an alternative method described by Cathey which in col. 6 line 49 states, " A further alternative as illustrated in fig. 5. "

Applicants' are reminded that any reference's entire disclosure must be taken as its teachings and all alternative embodiments are good prior art, and herein all other embodiments teach the use of recrystallized substrate. (eg. col. 5 lines 63-68, etc.).

d) Applicants' argue that Nakamura does teach or suggest melting a surface layer of polysilicon during the crystallization process .

It is noted that Nakamura describes the substrate is subjected to hydrogen plasma and excimer laser therefore it is clear to one skilled in the art that the surface of the substrate has to melt at such high temperatures during the recrystallization process.

Art Unit: 2814

It is alleged that Nakamura does not teach or suggest "unpaired bonding electrons on the surface of the thin film during the cooling solidification are terminated by hydrogen atoms in the hydrogen-containing atmosphere".

Nakamura in col. 5 lines 29-35 states, "As is clear from Table 2 above, amorphous silicon is subjected to laser annealing in atmosphere containing hydrogen in the production method of the present invention. Therefore, in accordance with the present invention, since dangling bonds are compensated for by hydrogen, mobility of carriers in polycrystalline silicon is improved."

From the above one skilled in the art would clearly understand that upon cooling (a step occurring after all laser treatments, the dangling (unpaired) bonds (bonding electrons) are compensated (terminated) by hydrogen (hydrogen atoms).

It is noted that Cathey in several embodiments teaches hydrogenation that perform laser recrystallization (eg. fig. 3B).

Therefore claim 1 is rejected over the combination of Cathey and Nakamura.

Claims 2 and 5-11 were alleged to be allowable as they depend upon allowable claim 1.

However, as shown above claim 1 is not allowable therefore claims 2 and 5-11 are also not allowable and are rejected for reasons previously set out and those set out above.

With respect to claim 12, Applicants' allege that the melting and cooling of the semiconductor surface and the unpaired bonding step are not taught by Cathey and

Art Unit: 2814

Nakamura , However as shown above under claim 1 both these steps are specifically taught.

Applicants' also allege Nakamura does not suggest using a gas containing a component element of the semiconductor thin film and hydrogen.

Nakamura , in col. 4 lines 59-64, states, " Thereafter, hydrogen plasma is generated between electrodes 55 and 56 and laser beams having a wavelength of 308nm are irradiated onto the amorphous silicon 53 through the window 52 by the XeCl excimer laser 59 such that the amorphous silicon 53 is crystallized in to polycrystalline silicon ."

Again it is clear to one skilled in the art that when laser beam is irradiated on to the amorphous substrate some of the silicon will be vaporized and forms a gaseous mixture of silicon (gas containing a component element of the semiconductor thin film) and the hydrogen plasma.

Therefore claim12 is rejected for reasons previously set out and those set out above.

Claims 13-18 were alleged to be allowable as they depend upon allowable claim 12.

However, as shown above claim 12 is not allowable therefore claims 13-18 are also not allowable and are rejected for reasons previously set out and those set out above.

Art Unit: 2814

With respect to claim 20, applicants' have not provided any facts or evidence to negate the showings of pages 3-4 of the previous office action.

Applicants' arguments that Nakamura does not disclose the positioning of the window is incorrect because as previously stated figure 6 shows the positioning (it is reminded that prior art drawings are also teachings of prior art).

It is further noted that since figure 6 is the only drawing shown it is clearly understood that all embodiments use this window positioning.

Further it is noted that the existence of other positioning possibilities is not the standard to determine the inherency.

The correct standard as disclosed in *Kropa V Robbie et al.* (CCPa 1951) 187 F.2d. 150, 88 USPQ 478, " For the doctrine of inherency to apply, it must inevitably happen".

As shown above fig. 6 is the window position for all the embodiments and indeed the only position shown. Therefore that single position will inevitably happen.

Applicants' arguments that Nakamura does not disclose the advantages of window positioning it is noted that current case law as stated in *Ex parte Masham*, " It has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from prior art apparatus satisfying the claimed structural limitations. *Ex parte Masham*, 2 USPQ 2d 1647 (1987).

There fore claim 20 is rejected for reasons previously stated and those stated above.

Claims 21-23 depending from claim 20 were alleged to be allowable as they depend upon allegedly allowable claim 20. However as seen above claim 20 are not allowable therefore claims 21-23 is also not allowable and is rejected for reasons previously stated and those stated above.

.Claim 25 was alleged to be allowable because it recites that the distance between the window and the thin film is larger than a shortest distance between the wall and the thin film when the high energy is supplied to the thin film.

As previously stated Nakamura in fig. 6 shows window 52, a wall (not numbered) and thin film 53, as window 52 projects beyond wall it distance from the thin film has to be larger than the distance between the film and the wall. (See also o/A/ mailed 4/11/00 page 4 lines 14-20).

Therefore claim 25 is not allowable and rejected for reasons stated above.

Claims 26-28 depend upon claim 25 and were alleged to be allowable because of their dependency on claim 25, however as shown above claim 25 is not allowable therefore claims 26-28 are also not allowable and are rejected for reasons previously stated and those stated above.

Claims 30 and 35 was alleged to be allowable because it recites that the high energy is supplied under a pressure in a vicinity of the introduction window that is higher than a pressure in the vicinity of the thin film in the supply chamber. (See also o/A/ mailed 4/11/00 page 5 lines 7-14).

In addition to teachings stated under claim 25 above the pressure differential is taught by Nakamura The high energy being supplied to the thin film that is set in the

Art Unit: 2814

supply chamber through the window that is disposed at a location resistant to adherence of components of the thin film, and the supply chamber also has an exhaust port wherein the pressure in the vicinity of the introduction window is higher (atmospheric) than the pressure (Vacuum) in the vicinity of the thin film in the supply chamber. (See also Col. 4, line 57). The recitation, "a pressure in a vicinity of the thin film higher than the pressure in a vicinity of the exhaust port in the supply chamber." will inherently occur when the air in the supply chamber is exhausted.

Therefore claim 30 is not allowable and rejected for reasons stated above.

Claims 31-33 depend upon claim 30 and were alleged to be allowable because of their dependency on claim 30, however as shown above claim 30 is not allowable therefore claims 31-33 are also not allowable and rejected for reasons set out above.

Claims 36-38 depend upon claim 35 and were alleged to be allowable because of their dependency on claim 35, however as shown above claim 35 is not allowable therefore claims 36-38 are also not allowable and rejected for reasons set out above.

B. Claims 40-43, 46-49 and 56-61 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cathey et al. (U.S. Patent No. 5,329,207 herein after Cathey) and Nakamura (U.S. Patent No. 5,200,630 herein after Nakamura) both previously applied to the above claims and further in view of Japanese Patent No. 62-3809 (herein after JP-3809, submitted by the applicants' in their IDS and also previously applied) for reasons stated in the previous office action and those stated below.

Art Unit: 2814

With respect to claim 40, first of all the mere recitation of the gas flow from the thin film in a particular direction does not patentably distinguish it over the prior art.

Assuming *arguendo* the recitation that direction of the gas flow from the thin film is approximately in the same direction as the reflection path is patentably distinguishable, Nakamura in fig. 6 and col. 4 lines 50-53 teaches the gas flow (Hydrogen) from the thin film in approximately the same direction (hydrogen gas to be vented out of the chamber through outlet 61) as the reflection path (reflection of hydrogen and plasma by mirror 58 through window 52 to reach thin film 53. Further more Reflected energy has a specular component which goes straight back to the source. Scattered energy has a wide spread and its direction is indeterminate. Also the flow shown in figure 3 is perpendicular to the scattered energy in some areas). (see also O/A mailed 7/18/01).

Therefore claim 40 is not allowable and rejected for reasons stated above.

Claims 41-43 depend upon claim 40 and were alleged to be allowable because of their dependency on claim 40, however as shown above claim 40 is not allowable therefore claims 41-43 are also not allowable and rejected for reasons set out above..

With respect to claims 46 and 56, it was alleged to be allowable because it recites " crystallizing" as stated under claim 1, however as shown under claim1 above the feature is obvious in view of the prior art.

The recitation of the film being also irradiated by a reflected beam does not patentably distinguish the claim over the prior art when the film is irradiated by the beam

However Jp-'722 fig.6 shows substrate 53 being irradiated by a beam, some of the beam will be reflected by the substrate and because of the window the beam will travel to mirror 58 and will be reflected back on to substrate 53 to form reflected energy that irradiates a second position of the thin film through a course change of the reflected energy.

Therefore claims 46 and 56 are rejected over Cathey, Nakamura and Jp'722 for reasons stated above and in the Office action mailed 11/17/99 (incorporated here by reference).

The motivation to combine Cathey, Nakamura and Jp-'722 is clearly set out on page 10 last two lines and page 11 lines 1-9 of the O/A mailed 11/17/99 and incorporated here by reference and it is noted that the motivation to combine is also to reduce grain boundary (i.e. defects) effects.

Claims 47-49 depend upon claim 46 and were alleged to be allowable because of their dependency on claim 46, however as shown above claim 46 is not allowable therefore claims 47-49 are also not allowable and rejected for reasons set out above..

Claims 57-61 depend upon claim 56 and were alleged to be allowable because of their dependency on claim 56, however as shown above claim 56 is not allowable therefore claims 57-61 are also not allowable and rejected for reasons set out above.

Claim 62 depend upon claim 1 and were alleged to be allowable because of their dependency on claim 1, however as shown above claim 1 is not allowable therefore claim 62 are also not allowable and rejected for reasons set out above.

Applicants' do not make any reference to claim 63 or state whether they traverse the outstanding rejections of claim 63.

It is noted for the record that claim 63 repeats the same steps as claim 2 above and is rejected for the same reasons set out above under claim 2.

Response to Arguments

Applicant's arguments filed 11/16/2001 have been fully considered but they are not persuasive for reasons set out at length above.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action.

As the same references as previously applied are also used in the current rejection this forms a separate and independent basis for this Final rejection.

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.


Art Unit: 2814

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven H. Rao whose telephone number is 703-306-5945. The examiner can normally be reached on M-F, 8.00 to 5.00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703- 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703- 308-0956.

January 25, 2002


OLIK CHAUDHURI
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800